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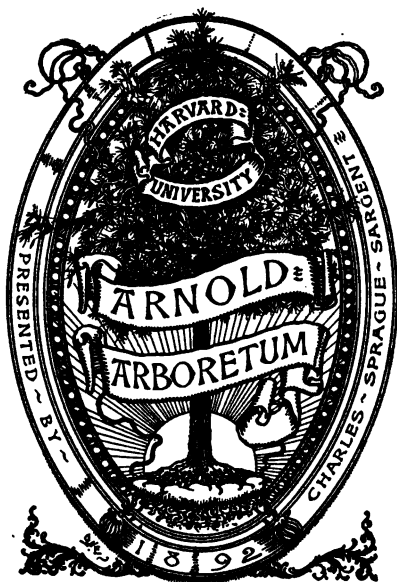
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I.
Government Forestry Abroad,

By GIFFORD PINCHOT.

II.
The Present Condition of the Forests
on the Public Lands,

By EDWARD A. BOWERS,
Secretary of the American Forestry Association.
(Formerly Inspector of Public Lands.)

III.
Practicability of an American Forest
Administration,

By B. E. FERNOW,
Chief of Forestry Division, Department of Agriculture, Washington, D. C.

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TABLE OF CONTENTS.

	PAGE.
I. GOVERNMENT FORESTRY ABROAD. By GIFFORD PINCHOT...	5
Germany.....	9
France.....	24
Switzerland.....	32
Australia.....	42
India.....	45
South Africa.....	50
Other Countries.....	52
II. THE PRESENT CONDITION OF THE FOREST ON THE PUBLIC LANDS. By EDWARD A. BOWERS.....	55
III. PRACTICABILITY OF AN AMERICAN FOREST ADMINISTRATION. By B. E. FERNOW.....	75
IV. APPENDIX: PROPOSED BILL.....	93

The three papers on Forest Administration here printed together were read at the joint session of the American Economic Association and the American Forestry Association, at Washington, D. C., December 30, 1890.

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Government Forestry Abroad.

BY

GIFFORD PINCHOT.

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The following article has been rather hastily prepared from such materials and experience as the writer was able to command, and while from the nature of the case it cannot claim to be a comprehensive treatment of the subject, it is believed that the statements and statistics which it contains are accurate.

Germany, France and Switzerland have been dwelt upon more at length, both because forestry has reached a wider development there, and because the writer can speak concerning them from personal observation.

The history of the forest has developed itself along similar lines in all the countries of Europe. Its course in the central part of the Continent, which may be taken as fairly representative of what it was elsewhere, is thus briefly summarized.

At first the forest held the same relation to man as to the game upon which he lived. His demand upon it was insignificant, but, as he advanced in the scale of civilization, he began to call upon the forest for greater supplies of timber, and especially for the pasturage of his herds. Until comparatively recent times this was the chief service which gave the wood

lands value. The increasing density of population and 'the more complicated needs of life then gave gradual rise to more vigorous attacks upon the forest. For a time the demand was small and the areas cut over easily covered themselves with young growth. The forest renewed itself and maintained its productive power. But, as the demand increased, the areas cut over increased with it, and the actual regrowth no longer kept pace with the quantity of timber which it was called upon to yield. At the same time the land needed for agriculture was being taken from the timbered area, and the wood lands, attacked along two lines, were beginning to suffer seriously.

"It is true," says Dr. Gayer,¹ "that the forest belonged at that time chiefly to the herdsmen and the game, but the steadily increasing tendency to destruction of a growing population made the general cultivation of the chase an undoubted advantage to the forest. Indeed the hunter has been at all times one of its best friends. For numerous acts of violence may be referred to, extending over the whole of mediæval times, as a result of which much free land belonging to the early communities, or the rights to its enjoyment, passed in course of time into the hands of the rulers. From a legal standpoint these are indeed events to be deplored, and from them the oppressive burden of actual prescriptive rights takes its rise, but the present extensive State forest holdings in Germany have chiefly to thank this universal love of *venerie* for their existence.

"It is unquestionably true that the forests have been at no time in a more deplorable condition than in the second half of the Middle Ages, and thence on to the middle of the last century. The results which must follow this condition of affairs were evident, and led to the most serious fears of a widespread timber famine. And although this foreboding, as it filled the minds of men toward the end of the Mediæval period, and as it was brought to the attention of the people through numerous publications, may have been exaggerated, nevertheless, in view of the commercial relations of the

¹Der Wald im Wechsel der Zeiten. Inaugural address as Rector of the University of Munich, November, 1889.

time and the narrow boundaries of supply, it was on the whole by no means unjustified. It gave, at least, the first impulse to economy. Under the influence of this universal sentiment, but perhaps caused even more by the interest in hunting and in the security of the rights of property, a gradual change for the better appeared in the destiny of the forest. Its importance as a national treasure had at all events penetrated the minds of the more intelligent classes.

"There begins now a time of restless work in the forest, a time of struggle for its preservation and rehabilitation, the results of which no other nation has realized so fully as the German.

"Apart from the measures which were demanded by the security of property and the economical ordering of forest utilization, the efforts of the forester were chiefly directed to the regeneration of the forest. This was accomplished in those regions which had partially escaped destruction by the assistance of the free regenerative power of nature, in the totally devastated areas by artificial means. The rational treatment of the wood lands had begun."

All forest management may be said to rest on two closely related facts which are so self-evident that they might almost be called axioms of forestry, but which, like other axioms, lead to conclusions of far-reaching application. These are, first, that trees require many years to reach merchantable size; and, secondly, that a forest crop cannot be taken every year from the same land. From the last statement it follows that a definite, far-seeing plan is necessary for the rational management of any forest, from the first; that forest property is safest under the supervision of some imperishable guardian; or, in other words, of the State.

GERMANY.

It is natural in treating the subject of State forestry to begin with Germany, since it is here that it has reached its furthest development and most stable condition. In Germany, then, the forests cover an

area of 13,908,398 hectares, or 26 per cent. of the total surface of the country. It is extremely significant, in view of the popular talk about the "inexhaustible" forest resources of the United States, to note that the latest available data put the percentage of wooded land in our country also at 26 per cent. It is true that the relative density of population in the two countries is a factor which enters largely into such a comparison, but it is equally true as regards the relative economy in the use of wood, and the fact that Germany is very far from supplying her own demand for timber. Further, the contrast between the permanent productive powers of the German and American wood lands, as they stand at present, adds another somber tint to the picture of our condition. In Germany, the State either owns or controls about two-thirds of the forest area, and for these lands the point of lowest production has been past. It is coming for us at a time when the need of timber is at its highest.

It is necessary when dealing with forest policy in the German Empire to treat independently the different States of which it is composed. Differences in forest organization and management have arisen through differences in politics and geography, even a superficial examination of which would exceed both the space and the scope of the present paper, and it is fortunately the less needful to go into so extended a discussion, because one common principle lies at the root of forest policy in each of them, and may be fully illustrated by reference to any one. This principle, special to no country or form of government, holds that "the State is the guardian of all public interests." It is in its interpretation that, for

the purposes of this paper, its chief interest lies. From this point of view "public interests" must be taken to mean all interests other than private ones. So understood, this maxim may be said to sum up the forest policy of nearly all the nations of Europe, as well under republican as under governments of a distinctly paternal character.

The Kingdom of Prussia, both as the head of the German Bund and as the State which has developed the forest organization most worthy to be taken as an example, will furnish the completest illustration.

Covering an area of some 8,153,946 hectares, the forests of Prussia occupy 23.4 per cent. of the total surface of the country. Of this wood land it may be said roughly that one-third is stocked with deciduous trees, and two-thirds with the less demanding conifers, a reversal of the old conditions, which is largely due to the deterioration of the soil and to the fact that the richer ground has been rightly claimed for agricultural uses. The ownership, a point of capital importance in relation to our subject, is divided as follows: To the State belong nearly 2,718,256 hectares, or 29 per cent.; to towns, village communities and other public bodies, 1,302,508 hectares, or 16 per cent., and to private owners 4,382,251 hectares, or 55 per cent.

The relation of the State to the forests which it owns is simple and rational, based as it is on the idea that its ownership will be permanent.

Holding it as a duty to preserve the wood lands for the present share which they take in the economy of the nation, the State has recognized as well the obligation to hand down its forest wealth unimpaired to future generations. It has recognized and re-

spected equally the place which the forest holds in relation to agriculture and in the economy of nature, and hence feels itself doubly bound to protect its wood lands.

In a word, it has seen that in its direct and indirect influence, the forest plays a most important part in the story of human progress, and that the advance of civilization only serves to make it more indispensable. It has, therefore, steadily refused to deliver its forests to more or less speedy destruction, by allowing them to pass into the hands of shorter lived and less provident owners. Even in the times of greatest financial difficulty, when Prussia was overrun and nearly annihilated by the French, the idea of selling the State forests was never seriously entertained.

But the government of Prussia has not stopped here. Protection standing alone is irrational and incomplete. The cases where a forest reaches its highest usefulness by simply existing are rare. The immense capital which the State wood lands represent is not permitted to lie idle, and the forest, as a timber producer, has taken its place among the permanent features of the land. The government has done the only wise thing by managing its own forests through its own forest officers.

The organization of the Forest Service is briefly as follows: At its head stands the Department, or more correctly, the Ministry of Agriculture, State lands and forests, which exercises general supervision over forest affairs through the medium of the (Oberland-forstmeister) chief of Forest Service. A part of this central office is the Bureau of Forest Surveys and Working Plans, a factor of very great impor-

tance in the general organization. A working plan is the scheme according to which the technical business of a forest range is carried out. "Its object," says Dr. Judeich,¹ "is so to order the management of a forest in time and space as to fulfill to the utmost the objects of this management." The following subdivision of the general subject of working plans is taken from his admirable work, "*Die Forsteinrichtung*." The first section is entitled "Preliminary Work," under which are included: forest surveys, forest or timber estimating (which includes "the investigation of all conditions inherent in the forest which have an influence on its present yield, or which are of importance for the calculation of its yield in the future;" that is, the very thorough study and description of both soil and timber), a study of the general and external conditions by which it is affected (its topography, history, ownership, nature of the surrounding land and people, and any other considerations which may influence its management), and, lastly, maps and records.

The second section, which may be called Forest Division for want of a better English name, considers the formation of ranges, each of which is in charge of an executive officer, then the division of the range into units of management called blocks, each of which is treated to a certain extent independently of the others, and into compartments, which are generally well over a hundred acres in extent, and are marked on the ground by open lanes and boundary stones. This second section contains also less important matters which cannot be touched on here.

¹*Die Forsteinrichtung*. 4th Ed. Dresden, 1885.

The third section, Determination of the Yield, explains the various methods of calculating and fixing the amount of timber which a given forest may be safely called upon to yield.

The next section treats of the construction of the working plans proper; that is, "of that document in which the essential results of the preliminary work, the determination of the yield and the regulation of the management are so put together that they may serve as a guide . . . to the executive officer of the range."

The final section relates to the posting and continuation of the working plans, especially as regards the periodic revisions, which take place in general at intervals of five and ten years.

Next in authority to the department just mentioned is the *Bezirksregierung*, a council in charge of one of the thirty-five minor divisions of the Prussian State, which has full control over forest business within its sphere of action. The members of the controlling staff, the *Oberförstmeister* and *Forstmeister*, are also members of this council. Their duties lie in the inspection of the officers of the executive staff, of whom there are 681 in Prussia. These officers, styled *Oberförster*, are charged with the actual management of the public forest lands, and it is on them that the security of public interest in the forests chiefly rests. Upon their selection and education the utmost care and forethought are expended.

Their course of training, one which has produced perhaps the most efficient forest staff of the present day, is briefly as follows: It begins, after graduation from a gymnasium, with a year of practical work

under some experienced Oberförster, to enter which the candidate is required to show, besides his certificate of graduation, that he is under twenty-two years of age; that he has certain moral and physical qualities, and that his financial resources are sufficient to carry him through his whole forest education. The object of this preparatory year is to introduce the beginner to the forest and its management; to enable him to become acquainted with the more important forest trees; to take part in planting and felling and the protection of the forest; to do a little surveying, and last, but by no means least, to learn to hunt. It may be said in passing that the love of hunting, which the Prussian forest service is careful to encourage, has very much to do with the faithfulness and efficiency of its individual members. Great stress is rightly laid on this year of preparatory work, chiefly because of the vastly greater force and reality which it gives to the subsequent theoretical teaching. As one who has suffered from the lack of it, I may perhaps be permitted to bear my testimony to the value of a custom which is unfortunately less widely extended than its merits deserve; but which I hope to see one day established in the forest schools of our land.

The young Prussian forester who has had the good fortune to pass through this preliminary year next spends two years at a forest school, presumably either Münden or Neustadt Eberswalde, both of which are in Prussia, and like all other similar German schools, are supported by the State. The candidate may, if he chooses, attend any of the other forest schools, of which Germany numbers six (Aschaffenburg and the Forest School of the Munich University, which

together form one complete institution; Tharand, Tübingen, Karlsruhe, Giesen and Eisenach), but he must cover the same ground as at the institutions which are standard. The technical school is followed by a year of jurisprudence and political economy at some university, and the young forester then comes up for the first State examination. He must present with his credentials the maps and field notes of a plot surveyed and a level run, as well as a timber map covering at least 1,235 acres, all his own work. The examination itself bears first on forestry, in which it requires a thorough knowledge of the general theory as to silviculture, working plans, calculation of the volume and yield of standing timber, its capital and selling value, the utilization of forest produce, forest technology, protection and police, and forest history and literature. In mathematics it demands about what is included up to the second year of one of our colleges, and in surveying the requirements are somewhat larger. Zoology, botany and mineralogy, especially the second, are strongly insisted on, while chemistry, physics and law command a smaller share of attention.

The examination is followed by at least two years of travel and work, during which the candidate, now promoted to the title of referendar, must perfect himself in the field and office management of a forest range. For this purpose he is required to spend five months in the practical administration of a range, under the responsibility of an Oberförster, and four months in the preparation of working plans. Half a year, including the months from December to May, is to be passed in the discharge of all the duties of an ordinary forest guard. During this time the

referendar is personally responsible for all that goes on in his beat, which must be the same for the whole period. At the end of this rather lengthy preparation comes the much-dreaded final examination, which, like the first, is held partly in doors and partly in the forest. This second test dwells more especially, apart from forestry proper, on law, political economy, finance, forest policy, and the organization of the forest service, but without slighting the laws and lore of hunting.

The referendar now becomes forest assessor, and is at length eligible for serious paid employment. The actual career of the forester can hardly be said to begin, however, until the appointment as Oberförster, for which the assessor has no sort of guarantee, and which may delay its coming for from six to twelve years. That once obtained, the list of promotion lies open, and includes every grade up to the highest. Still, it must be said that, as a rule, the Prussian Oberförster is wholly satisfied with his position, and very often unwilling to exchange it for one of greater honor and profit.

That it should be so is scarcely to be wondered at. The Oberförster, with almost independent control of a range of some 10,000 acres, and, what is of first importance to him, with an exclusive right to the excellent shooting which it usually offers, lives a healthy, active life, about equally divided between the woods, his office and his friends. His pay, which may reach 6,400 marks, including a consolidated allowance for horses and the incidentals of his office work, is ridiculously low from our standpoint, but entirely sufficient from his. Promotion means a change from the moderate activity of overseeing the planting and

felling of his forest, and the quiet of home life, to the constant activity of travel. The stimulus which ambition fails to give is supplied by the admirable *esprit de corps* which pervades the whole body of forest officers, and forms here, as elsewhere, the best security for the efficiency and healthy tone of the service.

Immediately subordinate to the members of the executive staff are the various grades of forest guards, upon whom the protection of the forest directly and exclusively rests. In general, each guard is in charge of one of the five beats into which the average range is divided. "The forester (I quote from the Service Instructions) must protect the beat entrusted to him against unlawful utilization, theft and injury, and see to it that the forest and game laws are observed. He is charged with the execution of the felling, planting and other forest work under the orders of the Oberförster, and he alone delivers all forest produce, on receipt of written instructions, to the persons qualified to receive it."

The training of the protective staff is provided for with a care which in any other land might be thought more suitable for officers of a higher grade, and a period of preparation only less long than that for Oberförster stands before the beginner.

But lest the necessity for so long a course of preparatory work should seem unduly to enhance the difficulties of forest management, it should be noted here that in countries whose grade of excellence in forest matters is closely second to that of Germany the schooling of forest officers is very considerably shorter. There will be occasion to refer to this matter further on.

Such is in outline the organization of the Prussian forest service. The principles upon which it rests are thus stated by Donner, now Oberlandforstmeister, in a work which carries all the weight of an official document.¹ He says:

"The fundamental rules for the management of State forests are these: First, to keep rigidly within the bounds of conservative treatment; and secondly, to attain, consistently with such treatment, the greatest output of most useful products in the shortest time."

And again:

"The State believes itself bound, in the administration of its forests, to keep in view the common good of the people, and that as well with respect to the lasting satisfaction of the demand for timber and other forest produce, as to the numerous other purposes which the forest serves. It holds fast the duty to treat the Government wood lands as a trust held for the nation as a whole, to the end that it may enjoy for the present the highest satisfaction of its needs for forest produce and the protection which the forest gives, and for all future time, at least an equal share of equal blessings."

The same authority elsewhere formulates the general status of the forest, as follows:

"The forest is a trust handed down from former times, whose value lies not only in its immediate production of wood, but also essentially in the benefit to agriculture of its immediate influence on climate, weather protection in various ways, the conservation of the soil, etc. The forest has significance not only for the present nor for its owner alone; it has significance as well for the future and for the whole of the people."

With respect to the second class of forest property, that belonging to towns, villages and other public bodies, it is again impossible to speak for the whole of Germany except upon the broadest lines. The State everywhere exercises oversight and a degree of control over the management of these forests, but the sphere of its action varies within very wide limits. Even within the individual states it does not remain

¹ *Die Forstliche Verhältnisse Preussens*, 2d ed., Berlin, 1883.

the same. Thus far, however, the action of the Government is alike not only throughout Prussia but in all parts of Germany. It prevents absolutely the treatment of any forest of this class under improvident or wasteful methods; nor does it allow any measure to be carried into effect which may deprive posterity of the enjoyment which it has a right to expect. How far the details vary may be gathered from the fact that while in the Prussian provinces of Rhineland and Westphalia the village communities appoint their own forest officers and manage their own forests, subject only to a tolerably close oversight on the part of the controlling staff, in the former Duchy of Nassau, now Prussian territory, their share in the management does not extend beyond the right to sell the timber cut under the direction of the Government Oberförster, the right and obligation to pay for all the planting and other improvements which may be deemed necessary, and the rather hollow privilege of expressing their opinion. But however galling so extensive an interference with the rights of property may appear, it is none the less unquestionably true that in France, as well as in Germany, the State management of communal forests lies at the root of the prosperity of a very large proportion of the peasant population, and the evils which have attended its withdrawal in individual cases are notorious. While on the one hand villages whose taxes are wholly paid by their forests are by no means rare, on the other the sale of communal forest property in certain parts of Germany in 1848 has been followed with deplorable regularity by the impoverishment of the villages which were unwise enough to allow it.

The relations of the State to the third class of forests, those belonging to private proprietors, are of a much less intimate nature. The basis of these relations is, however, the same. To quote again from Donner, "The duty of the State to sustain and further the well being of its citizens regarded as an imperishable whole, implies for the Government the right and the duty to subject the management of all forests to its inspection and control." This intervention is to be carried, however, "only so far as may be necessary to obviate the dangers which an unrestrained utilization of the forest by its owners threatens to excite, and the rights of property are to be respected to the utmost consistently with such a result." Prussia, of all the German countries, has respected these rights most highly, and the Government exerts practically no restraining influence except where the evident results of deforestation would be seriously dangerous. Here it may and does guard most jealously the wood lands, whose presence is a necessary safeguard against certain of the more destructive phenomena of nature, and which have been called in general protection forests. Of their many sided influence so much has been said and written of late in America—both truly and falsely—that no farther reference to the subject seems needful.

The State leaves open a way of escape for the private proprietor who finds himself unwilling to suffer such restriction of his rights for the public good, and shows itself willing to buy up areas not only of protection forest but also of less vitally important wood lands. On the other hand, it is ready, with a broadness of view which the zeal of forest authorities sometimes unfortunately excludes, to give up to pri-

vate ownership lands which, by reason of their soil and situation, will contribute better to the commonwealth under cultivation than as forest. In this way the forests whose preservation is most important are gradually passing into the hands of the State; yet the total area of its wood lands is increasing but slowly.

The policy of State aid in the afforestation of waste lands important through their situation on high ground or otherwise is fully recognized (a notable example exists upon the Hohe Venn near Aix-la-Chapelle), but the absence of considerable mountain chains has given to this branch of Government influence very much less prominence than in the Alps of Austria, Switzerland and France, where its advantages appear on a larger and more striking scale.

In closing this brief sketch of forest policy in Prussia, you will perhaps allow me to refer for a moment to the erroneous ideas of German forest management which have crept into our literature. They have done so, I believe, partly through a desire of the advocates of forestry to prove too much, and they injure the cause of forestry, because they tend to make forest management ridiculous in the eyes of our citizens. The idea has arisen that German methods are exaggeratedly artificial and complicated, and not unnaturally the inference has been made that forestry in itself is a thing for older and more densely populated countries, and that forest management is inapplicable and incapable of adaptation to the conditions under which we live. It is true, on the contrary, that the treatment of German forests is distinguished above all things by an elastic adaptability to circumstances, which is totally at variance with the iron-clad

formality which a superficial observation may believe it sees. It is equally true that its methods could not be transported unchanged into our forests without entailing discouragement and failure, just as our methods of lumbering would be disastrous there; but the principles which underlie not only German, but all rational forest management, are true all the world over. It was in accordance with them that the forests of British India were taken in hand and are now being successfully managed, but the methods into which the same principles have developed are as widely dissimilar as the countries in which they are being applied. So forest management in America must be worked out along lines which the conditions of our life will prescribe. It never can be a technical imitation of that of any other country, and a knowledge of forestry abroad will be useful and necessary rather as matter for comparison than as a guide to be blindly obeyed.

It must be suited not only to the peculiarities of our national character, but also to the climate, soil and timber of each locality, to the facilities for transportation, the relations of supply and demand, and the hundred other factors which go to make up the natural character of a hillside, a county, or a State. Its details cannot be laid down *ex cathedra*, but must spring from a thorough acquaintance with the theory of forestry, combined with exhaustive knowledge of local conditions. It will necessarily lose the formality and minuteness which it has acquired in countries of older and denser settlement, and will take on the character of largeness and efficiency, which has placed the methods of American lumbermen, in their own sphere, far beyond all competitors.

All forest management, as contrasted with our present hand-to-mouth system of lumbering, must mean the exchange of larger temporary profits for returns which are indeed smaller, but which, under favorable circumstances, will continue and increase indefinitely.

Under these conditions I do not believe that forest management in the United States will present even serious technical difficulties. It only asks the opportunity to prove itself sound, practical and altogether good.

FRANCE.

In France, which stands with Germany at the head of the nations as regards thoroughness of forest policy, the large extent of government and other public forests is in excellent condition. The struggle for their care and preservation, the necessary antecedent of their present favorable situation, has a history which reaches back far beyond the time when the United States became a nation. Says M. Boppe, in the introduction of his *Traité de Sylviculture*:¹

"In early times, during the Middle Ages, and until the beginning of modern times, the knowledge of the specialists was summed up in certain practices of lumbering put together in a way to satisfy needs which were purely local. The wood was cut methodically, but without much care as to the manner in which it would grow again; that was the business of Dame Nature. Speaking of France alone, it is known that towards the middle of the sixteenth century, in spite of the fact that lumbering was restricted by limited demand (since, in the absence of the more powerful means of transportation, the wood must be put in use almost where it was felled); in spite of the repeated intervention of royal authority, the lack of foresight and abuses of all sorts resulted in the notable

¹ Paris, 1889.

impoverishment of our forest domain. It was then that a man of genius, Bernard de Palissy, called the carelessness of his times in respect to the forests 'not a mistake, but a calamity and a curse for France.'

"Henry IV made every effort to put an end to the destruction, but it was reserved for Louis XVI, or rather for his minister, Colbert, to reconstruct on a solid basis the foundation of forest ownership. The law of August, 1669, which is in itself a whole forest code, will remain a legislative monument from which we cannot too much draw our inspiration."

The history of forestry in France continued to be associated with illustrious men in more recent times, among whom Recamier, Duhamel and Buffon were the first to "define the first principles of a rational forest management, based on the knowledge which had been gained of vegetable physiology."

France differs from Germany in the unity of her forest law. The Forest Code,¹ which closed in 1827 the series of forest enactments since the time of Colbert, is still in force. Its provisions, altered but little by the political changes which have passed over them, are valid for the whole of France.

In accordance with them certain classes of forest property are to be administered directly by the State forest service, along the lines which it marks out. These are the woods and forests which formed part of the domain of the State, those of communes and sections of communes, those of corporations and public institutions, and finally those in which the State, the communes or the public institutions have joint rights of property with individuals.

The area of forest owned by the French government reaches a total of 2,657,944 acres, or about one-ninth of the whole wooded area, which itself covers 17 per cent. of the country. Considerably more than

¹Consult *Code de la Legislation Forestiere*, per A. Puton, Paris, 1883.

half of the Government forests stand on hilly or mountainous land. The forest administration to which their care is entrusted is attached to the Department of Agriculture, and the Minister of Agriculture is president of the Forest Council. This body includes the Director of the Forests and three administrators, the first of whom is at the head of the Bureau for Legal Matters, Forest Instruction, Records and Acquisitions; the second of the Bureau of Working Plans and Utilization, and the third of that for Reforesting the Mountains, Public Works, Replanting and Clearing.

The personnel under the general direction of this council consists of 36 conservators, who are the higher inspecting and controlling officers; 225 inspectors, who are in administrative charge of divisions called *inspections*; 242 assistant inspectors, the executive officers, each of whom personally directs the work in his *cantonment*, and 328 officers of lower rank, called *gardes généraux*, whose work, in many cases similar to that of the grade above them, is difficult to define. Besides the 834 members of this superior branch of the service, there were in 1885 some 3,532 forest guards of various grades. It is safe to assume that the force of the protective staff has remained substantially the same.

The system of training for the service of the superior staff differs widely from that which we have seen in Germany. There is but one higher forest school, that at Nancy, in place of the numerous institutions of the Germans, and until very recently the whole course of preparation required of candidates for the government service consisted in the two years of study which it offered. At present entrance

to the forest school is open only to graduates of an agricultural institute in Paris, but this innovation had its rise rather in political than in educational grounds. The fact remains that the French forester, with a course of training only from a fourth to a third as long as that of his German colleague, has produced results whose admirable educational and intrinsic value stands unquestioned.

All French government forest officers must pass through the school, and the demands of the vast territory under their care are supplied by an annual list of graduates, which does not in general exceed ten or twelve.

Such facts make the task of national forest administration seem lighter as we look forward to the time when it must be begun.

There is a professional school at the *Domaine des Barres* for men of the higher grade of forest guards who have shown the ability and the ambition to rise to the lower rank of the superior staff. There were last year twelve students in attendance.

The management of the wood lands of communes and public institutions, which cover together an area of 4,715,124 acres, has been already shown to rest with the State forest service. These facts are made the subject of special provisions in the Forest Code, of which the following are the most important:

The communes, corporations and other public bodies may make no clearing in their forests without an express and special permit from the President.

Communal forests can never be divided among the inhabitants.

A quarter of the forests belonging to communes and other public bodies shall always be placed in

reserve when these communes or public bodies shall possess at least ten hectares (24.7 acres) of forest.

The choice of forest guards, made by the class of proprietors in question, must be approved by the Government forest service, which issues their commissions to the guards. These last stand in all respects on the same footing as the guards of the State forests.

The sale of wood is made under the direction of the State forest officers, and in the same way as for the State forests. The amount of wood needed for actual use by the members of the community is reserved at the time of sale, and the distribution is made among them with the family as the unit.

In return for a fixed tax all the operations of conservation and management in the woods of communes and public bodies are carried out by the members of the State forest service without further charge.

The object of the reserved quarter (*quart en réserve*) of the forests of communes and public institutions, mentioned above, is to provide for emergencies and special demands upon the treasury of their proprietors, such as damage by fire or flood, the building of a church, a school-house or a public fountain.

Except when silvicultural reasons may require it to be cut, such extraordinary necessities alone justify a draught on this simple kind of reserve fund.

The great majority of the forests owned by the class of proprietors just mentioned are managed under the system of "coppice under standards," a name which literally reproduces the French *taillis sous futaie*. This method of handling a forest implies an upper and a lower store of growth. The basis

of the treatment is a cutting over of the coppice shoots or sprouts which spring up from the old stumps at regular intervals of from fifteen to forty-five years. In order to make the return annual and fairly uniform it is only necessary to divide the whole forest, if it be small, or each of its units of management, if it be large, into as many compartments of equal productive power as there are years in the rotation of the coppice, and to cut over one such compartment each year.

At each cutting the best of the young seedlings which may have grown up among the coppice, or of the coppice shoots themselves if the seedlings are wanting, are left to grow on for two, three, four or even five rotations of the underwood. Being thus comparatively isolated these standards produce wood very rapidly, while, at the same time, their number is so restricted that they do not seriously interfere with the growth of the coppice by their shade. The disadvantages of the treatment are the large proportion of low-priced firewood which it yields, and the severe demands which it makes upon the soil. But this "national French treatment," as it has been called, has very many qualities which recommend it. It is the form of treatment which yields the highest per cent. of return on the capital invested, as well as the highest absolute volume of wood (if we except the high forest of coniferous trees). According to the forest statistics of 1878, the most recent source of information, the average yield of coppice under standards in France, under State management, was fifty-nine cubic feet of wood per acre per annum, about one-fourth of which was lumber and the rest fuel, hoop-poles. etc. A net annual return of 5 per

cent. may be set as the upper limit of production of this class of forest, and therefore far beyond that of other forms of treatment.

In 1878 the average net revenue of all the State forests was 32.00 francs per hectare per annum, or about \$2.50 per acre. The return on the capital which they represented was stated at $2\frac{1}{2}$ per cent. As an illustration of the general financial situation of forestry in France, the budget of the forest service for 1891 may be cited. It provides for expenses in the round sum of fifteen and a half million of francs, and anticipates a gross revenue of twenty-five million. If we subtract the cost of re-foresting the mountains, managing the Algerian forests, which, as yet, cost more than twice as much as they bring in, and similar items which are not directly connected with the current expenses of forest management, we reach a total of ten million francs in round numbers. Subtracting similarly the Algerian income we find that the net revenue is expected to reach the sum of fourteen million francs. Forest management on this basis is very far removed from sentimentalism and the philanthropic forest protection whose watchword is "Hands off."

The provisions of the code concerning private wood lands are substantially as follows:

No private owner may root up or clear his wood lands without having made a declaration of his intention at least four months in advance. The forest service may forbid this clearing in case of the maintenance of the forest is deemed necessary upon any of the following grounds:

1. To maintain the soil upon mountains or slopes.

2. To defend the soil against erosion and flooding by rivers, streams or torrents..

3. To insure the existence of springs and water-courses.

4. To protect the dunes and seashore against the erosion of the sea and the encroachment of moving sands.

5. For purposes of military defense.

6. For the public health.

A proprietor who has cleared his forest without permission is subject to a heavy fine, and may be forced in addition to replant the area which he has cleared.

The area of forest in France has certainly passed its lowest point. The following figures, compiled in 1889, will serve to illustrate this statement:

No government forests have been sold since 1870, while their area since 1872 has been increased by 190,462 acres. Private owners have been allowed to clear an area amounting to 960,849 acres since 1828, or 10,225 within the last five years, while the clearing of communal forests since 1855 and 1885, respectively, has been 24,826 acres and 598 acres. It should be added that an unknown quantity of land has been cleared without leave, and that on the other hand private owners have been in the habit of getting permits to clear their land as a means of enhancing its selling value and then leaving it still under forest.

Perhaps the most brilliant work of the French foresters has been accomplished in the correction of the torrents in the Alps, Pyrenees and Cevennes, in the course of which over 350,000 acres have been re-wooded under difficulties which seem almost insurmountable. Its picturesque character, its thorough

success and the sharpness of the moral which it serves to point have rightly made this branch of forestry in France a favorite subject for writers and speakers on forest reform. There is, then, the less need to do more than add that of the total cost to the French government, some 50,000,000 of francs, about one-half was consumed in engineering works whose direct object was to make the replanting of the drainage areas of torrents possible. "The forest thus restored to its natural place is alone able," says M. Demontzey, the eminent French authority, "to maintain the good, but precarious, results of the works of correction in the water-ways themselves." The disappearance of this forest in the first place may be traced in most cases directly to mountain pasturage, and the whole story of *reboisement* in France is full of the deepest interest in comparison with the present state and probable future of our mountain forests.

The planting of the dunes and the Landes, the first of which especially was an achievement of which any nation might well be proud, remain to be mentioned, but the information available to the writer at the moment is neither recent nor complete, and these matters must be left untouched in the present paper.

SWITZERLAND.

I pass now to Switzerland, a country where the development as well as the actual condition of forest policy may well claim our attention. The history of forestry in the Swiss republic is of peculiar interest to the people of the United States, because in its beginnings may be traced many of the characteristics of the situation here and now, and because the Swiss,

like the Americans, were confronted by the problem of a concrete forest policy extending over the various states of a common union. The problem has been brilliantly solved, and not the least result of its solution is the fact that the people of Switzerland have recognized the vast significance of the forests in so mountainous a country, and a full and hearty appreciation and support of the forest policy of the Confederation fills every nook and corner of the land.

The history of the forest movement in Switzerland has not yet been fully written, but you will allow me to quote from an unpublished sketch of it by Professor Landolt, who, more than any other man, has contributed to make that history of which he writes. As an example set by a republic to a republic, as the brilliant result of the work of a few devoted men, crowned by a public opinion which they created, and rewarded by the great and lasting blessing which they have brought to their country, I believe that the advocates of forest reform in America can set before themselves no better model and take encouragement from no worthier source.

"Soon after the middle of the last century," begins Professor Landolt, "certain intelligent, public spirited men of Zurich and the canton of Bern (which then included Waadt and a great part of Aargau), turned their attention to the situation of agriculture and forestry in Aargau. Their object was to gain a knowledge of the conditions involved and their surroundings, and to remove the most pressing evils.

"In the years between 1780 and 1790 the cantons, following the lead of Bern, succeeded in appointing forest officers, whose first task was to become conversant with the actual management of the State and large communal forests, and to make suggestions for their future treatment. Partly at this time, partly earlier, a large proportion of the State and a few communal forests were surveyed and a few of them were marked off into compartments on the ground, a measure of vital importance to conservative management.

"The appointment of State forest officers is to be regarded as the beginning of regular forest management. Great numbers of forest regulations bearing on the most various subjects—tree planting among others—had been promulgated in former centuries. They had been often renewed, but without forest officers they could not be enforced.

"Forest regulations were now made by Bern, Zurich, and for the Jura by the bishop of Basel, who also had appointed forest officers.

"The treatment of the State and of a few of the larger communal forests made very satisfactory progress until 1798. Then came the revolution, and with it war and times of great disturbance and political excitement. It is true that even then forestry was never wholly neglected; but the progress made, where it existed at all, was of very minor importance. But as times grew quieter and the condition of the government more orderly, the interest in forest matters revived; the cantons Neuenburg, Freiburg, Solothurn and Aargau passed forest laws of more or less comprehensive scope, appointed forest officers, and in general sought to promote the cause of forestry.

"Until about 1830 forestry in the less mountainous parts of Switzerland developed slowly, but still in a satisfactory manner. New laws appeared, the number of forest officers increased, the wood lands of communes and public institutions attracted more attention, and the future reforestation of the country became gradually the centre of greater effort. In public forests other than those of the State, progress was in general slow, although a considerable number of forest surveys were carried out.

"The mountain forests, however, with few exceptions, were in complete disorder. But the following years brought new life not only into politics, but also into national economies and the status of the forest, which last was materially improved by the floods which spread in 1834 over the greater part of the Alps. The damage which they caused was so severe that the philanthropic and scientific societies set themselves the task of searching out the cause of inundations, which became more frequent as time went on. They concluded that it was to be found largely in the improvident destruction of the mountain forests. To the fear of a wood famine, which had hitherto been the chief incentive to the advancement of forestry, there was now added another, which, if not wholly new, still had been formerly little insisted on. It was the influence of forests on rainfall and the phenomena of nature in general. The societies did not fail to direct attention to this question, and with excellent result. The less mountainous cantons with imperfect legislation made new laws or amended and completed the old ones, saw to the appointment of

foresters, and took the organization of the felling, planting and care of their timber seriously in hand. But the chief gain lay in the fact that the mountain cantons applied themselves to the work. St. Gallen, Luzern and Freiburg had already begun, and now went vigorously forward. Graubunden, Tessin and Wallis passed forest laws and appointed forest officers, partly at once, partly later; but still the progress made was slow. The cities everywhere made important contributions toward a better system by the introduction of a wiser treatment and by the appointment of foresters of their own, and so set a good example to the cantons and private forest proprietors. Those cantons of the plains also which had formerly given scant attention to their communal forests, as was here and there the case, now supervised and managed them better.

"Taken as a whole, Forestry has made satisfactory progress as regards legislation, the improvement of forest management and the increased number of forest officers, from the beginning of the 40's on. In 1865 the Swiss Forest School was established (as a fifth department of the Polytechnicum at Zurich), and provision was thus made," says Prof. Landolt, "for a forest staff of our own, educated with special reference to our own conditions.

"The Swiss Forestry Association was founded in 1843. Through frequent agitation, and by setting forth what action was necessary, it has rendered great service to the cause of forest protection. It has moved successfully, among other things, for the foundation of a forest school, the examination of the higher mountain forests, the passage of a new forest law, and the correction of the torrents.

"In 1854," continues Prof. Landolt, "I called the attention of the Association to the investigation of the mountain forests. In 1855 I was entrusted with the preparation of a memorial to the Federal Assembly, which was approved and presented in the following year. In 1858 the Federal Assembly appointed a commission of three men with authority to study and report upon the Swiss Alps and the Jura in regard to geology, forestry and police regulations, bearing on water supply. From the appearance of the final report of this commission in 1861, the improvement of Swiss forestry has been kept steadily before the Confederation. In 1875 a federal forest inspector was appointed, and a year later the first Swiss forest law was passed. This law does not extend to the whole of Switzerland, but only to the Alps and the steeper foot-hills. More recently attempts have been made by the cantonal government and the Forestry Association to extend its influence to the Jura or to the whole of Switzerland, but the need of such action is not yet clearly apparent."

The passage of the federal forest law was followed almost everywhere immediately by the appointment of trained forest officers, and all the cantons whose forest legislation was defective amended or completed it. At the same time federal and cantonal regulations bearing on watercourses were being revised.

"Our forest laws," Prof. Landolt goes on, "are intended to work more through instruction, good example and encouragement than by severe regulations. This method is somewhat slower than one which should involve more drastic measures, but the results achieved are the more useful and lasting. When forest proprietors do something because they are convinced of its utility, it is done well and with an eye to the future; but what they do under compulsion is done carelessly and neglected at the first opportunity. What they have come to learn in this way, and have recognized as good, will be carried out, and that better and better from year to year.

"All our laws require the same treatment for the forests of the State, the communes and public institutions. Still, progress in the treatment of State forests and those of the larger communes is more rapid than in those of corporations and the smaller villages. In the first more money is available, the forest officers are better trained, and there is a more intelligent grasp of the situation. But still the condition of the smaller forests is now satisfactory.

"The oversight of private forests is less strict. Their owners may not reduce the area of their wood lands without the consent of the cantonal government, must plant up the land cut over which is without natural growth, and are bound to take proper care of the growing stock, but they are not held to a conservative management.

"The regulations which bear upon the protection of wood lands, and the harmful external influences to which they are exposed, are equally binding upon them; but in return they enjoy the protection which the law provides for the forest.

"In protection forests, on the other hand, the timber that may be cut by private owners is marked by government officers, so that reckless lumbering may be prevented. The regulations which look to the formation of new protection forests must also be conformed to by private proprietors, or they must allow themselves to be expropriated. In these matters the Confederation and the cantons work in unison. The consent of the Federal Assembly is necessary to the clearing of private land in protection forests."

The Federal forest law, of which Prof. Landolt writes, is binding over nearly two-thirds of all Switzerland. Its chief provisions are the following:

The supervision of the Confederation is exercised, within the forest area over which it has special jurisdiction, upon all protection forests, and furthermore upon all State, communal and corporation wood lands, even when they do not fall under that head.

The cantons must appoint and pay the number of suitably educated foresters necessary for the execution and fulfillment of the forest law.

All forests which fall under Federal supervision must be demarcated on the ground within five years from the passage of the law.

The burdening of the wood lands with new prescriptive rights of certain kinds is forbidden.

The State, communal and corporation forests are to be surveyed, their management regulated, and working plans for them must be drawn up.

The federal machinery for the enforcement of this law is contained in the office of the Inspector-General of Forests, whose sphere of action extends over all the wood lands in question. Each canton has its own forest organization. The Federal Forest School, of which Prof. Landolt was founder, and in which he still teaches the forest sciences, remains in Zurich.

After what has been said it need hardly be added that the forests of Switzerland are for the most part in admirable condition. Systematic forest management has probably been known there as long as anywhere in Europe, and nowhere can finer individual examples be found. I have seen nothing, even in Germany, which seemed to me to be so workmanlike as the management of the Sihlwald, a forest belong-

ing to the city of Zurich; and I am the bolder in my opinion because the Sihlwald has been called the most instructive forest of Europe by one who is perhaps the most experienced forester of the present day. It may not be out of place to quote certain details of its history and management from a paper of the writer's which appeared in *Garden and Forest* in July and August, 1890.

The ownership of the city of Zurich in its forest is of very old date. Evidences of the care which the burghers bestowed upon it are found in a series of ordinances which, beginning in 1309 with a rule that no forester might cut wood in the Sihlwald—clear proof that a forest police existed at that early date—continued in unbroken succession to that of 1417, under which the foundation of the present organization was laid, and finally, in 1697, reached the first technical working plan. It is curious to note, as an evidence of the view of the nature of its interest held by the city, that the policy of adding to the public forest property by purchase, recently inaugurated by the Legislature of the State of New York, was begun by the free city of Zurich nearly two centuries before the discovery of America.

“In the organization of a normally stocked forest the object of first importance is the cutting each year of an amount of timber equal to the total annual increase over the whole area, and no more. It is further desirable in any long settled community that the forests be so managed as to yield a measurably constant return in material. Otherwise difficulties in the supply of labor and the disposal of the produce make themselves felt, and the value of the forest to its owner tends to decrease.

“In order to attain this steadiness of yield it is obviously necessary that a certain number of trees become fit to cut each year. The Sihlwald has accordingly been so “regulated” that areas of equal productive capacity are covered by stocks of every age, from

last year's seedling to the mature tree. These age-gradations succeed each other in a series so regular that in an hour's walk one may pass from the area just cut over through a forest of steadily increasing age to the trees which have reached the limit of the rotation of ninety years. Three such units of management are present in the Sihlwald, but . . . it will be necessary to speak of only one of them. The working plan for the Lower Sihlwald, then, prescribes for the forest which it controls the operations of what Dr. Schlich has called in his *Manual of Forestry* 'The Shelter-wood Compartment System.' It may not be without interest to follow the life history of a compartment in which this system is carried out.

"After the mature trees had been felled and removed from the area which furnished the yield of the Lower Sihlwald last year the thick crop of seedlings which had grown up under their shelter was finally exposed to the full influence of the light and air. The felling and rough shaping of the timber, the piling of logs and cordwood and the trampling of the men had combined with the crisis of exposure to destroy the new crop in places and create a few small blanks. Here, as soon as the disappearance of the snow had made it possible, groups of the kinds of seedlings necessary to preserve the mixture or destined to increase the proportion of the more valuable species were planted. The operation, necessarily an expensive one, is justified by the greater resistance of a mixed forest to nearly all the calamities which may befall standing timber. Simultaneously with the planting the willows, hazels and other worthless species were destroyed, as well as the 'pre-existing seedlings,' whose larger growth, according to the disputed theory held at the Sihlwald, would damage their younger neighbors more by their shade than their greater volume would increase the final yield of timber. The incipient forest, then, practically uniform in age and size and broken by no blanks which the growth of a year or two will not conceal, is fairly started on the course of healthy development which it is to continue undisturbed until it reaches the age of fifteen years.

"At this point occurs the first of a series of thinnings (or more exactly, 'clearing' at first and thinning later), which follow each other at intervals of seven or eight years, until the trees have entered the last third of their existence. There is, perhaps, no silvicultural question more in dispute than this of the time and degree of thinning which will yield the best results in quality and quantity of timber. The method pursued at the Sihlwald, consecrated by habit and success, gives ample space for the healthy development of the crown from a very early age without admitting

light enough through the leaf-canopy to sustain an undergrowth until the trees are nearly ready to give place to their descendants. Such shrubs or seedlings as still appear, thanks to a shade-bearing temperament, are systematically cut out. It may be strongly doubted whether such a policy might safely be applied on soil less moist than that of the Sihlwald; but here, at least, the trees reach the age of sixty years, tall, straight, clean-boled, and in condition to make the best of the last part of the period of maximum growth, which a large number of measurements have shown to occur in general between the ages of seventy and ninety years. A heavy thinning now comes to the assistance of the best specimens of growth, and they are left to profit by it until seven years before the date fixed for their fall. Then begin the regeneration cuttings, whose object is to admit through the leaf-canopy an amount of light, varying with the temperament of each species, whose mission is to give vitality to the seedlings which the trees, stimulated themselves by their more favorable situation, now begin to produce in considerable quantities. To this end the light which falls from above has a powerful auxiliary in that which the system of felling each year in a long, narrow strip admits from the side, and so admirable is this double method that the time which elapses between the beginning and the end of a regeneration is but half the average for less favored localities. This applies only to the deciduous trees. The time required by the conifers is much longer, and the incomplete regeneration which they furnish is supplemented by planting in the blanks already mentioned. But for the self-sown seedlings of both classes the amount of light is gradually increased, the trees which sheltered them are at length wholly removed, and the cycle of growth repeats itself.

"With an average stand of timber of 2,800 cubic feet per acre, the annual yield of wood, almost half of which is from thinnings alone, reached last year 377,023 cubic feet, an amount which may be taken as slightly above the average.

"Under the management of Forstmeister Meister the 2,400 acres of the Sihlwald gave last year (1889) a net return of something over \$8 per acre, or a total contribution to the treasury of the city of about \$20,000. This sum, large as it is in relation to the area of forest which produced it, promises to be materially increased.

"But with the climate of northern Europe indicated by a mean temperature of forty-eight degrees Fahrenheit, and with the conditions of soil and moisture which it enjoys, the exceptional productiveness of the Sihlwald would still remain partly unexplained were it not possible to add that the land which it covers has been uninterruptedly under forest for something over a thousand years. That

precious condition of the surface which the French and Germans unite in describing as 'forest-soil,' so slow in forming and so quick to disappear wherever the full sunlight is allowed to reach the ground, has here been produced in perfection by centuries of forest growth. It is perhaps to this factor, next to the abundance of humidity, that the high annual yield of wood in the Sihlwald is due."

It has been remarked already that there are reasons which give the study of forestry in Switzerland peculiar value—a value which, in the opinion of the writer, far surpasses that of the more refined German forest organization. For the fundamental difference of political training in the German and Swiss forester works itself out in the character of forest management with perfect clearness. "The first," says Forstmeister Meister, one of the most eminent of Swiss or of European forest officers, in summing up the matter to the writer, "has always before his eyes a forest organization regulated down to the minutest detail. It is with this organization that he is to deal as best he may. The Swiss (or the republican) standpoint, on the other hand, requires the forester to reach the best result which is possible at the moment by an intelligent application of the general principles of forestry through the medium of forest organization, "which is imperfect and incomplete." It seems hardly necessary to point out along which of these lines the work of the American forester must be shaped, or from which point of view he must approach it. It is an admirable training to become thoroughly at home in the details of the most complete forest organization, but it is a far more practically useful thing in the United States to be able to do without it.

AUSTRALIA.

Before touching on the matter of forest management in certain of the English colonies, it is of interest to note the relations of timber import and export throughout the British Empire. These are given by Dr. Schlich¹ for the average of the five years from 1884-88 as follows:

Imports—United Kingdom.....	£15,000,000
British Colonies.....	1,466,000
Total.....	£16,466,000
Exports—Dominion of Canada ..	£ 4,025,000
Other Colonies.....	713,000
Total—.....	4,738,000

Excess of imports over exports £11,728,000, or \$56,800,000.

It should be noted that this table is not quite complete, but it will answer all the purposes of illustration, and the light which it throws on the general timber supply of the world is exceedingly interesting, even if it be not alarming.

Forest legislation in Australia is still in a transition state. It has already had time to correct some of its earlier mistakes, and the course which it is following will certainly lead to a satisfactory forest policy in the end.

In the colony of South Australia an act was passed in 1873 dealing, as such preliminary legislation generally has dealt in recent times, with the encouragement of tree planting. A forest board was established in 1875 and a conservator of forests in 1877; and in 1882 "The Woods and Forest Act" became

¹Lecture before the Royal Colonial Institute on March 11, 1890. My information on the forest policy of the Australian colonies is derived from the same source.

law. It entrusts the charge of all forest estates to the Commissioner of Forest Lands, and gives him power to grant licenses and make regulations for cutting timber, bark, or other forest produce, and he may levy fees upon stock pasturing in forest reserves. It provides also that all forest reserves heretofore declared such shall remain so, and empowers the governor to add to their area; makes provision for encouraging tree-planting, and for the leasing of forest lands under certain conditions. The appointment of conservators is authorized, and the issuance of regulations for the management of the forest, the disposal of the timber, and the prevention of fires. The financial result of this policy during the thirteen years ending with 1889 was a net surplus of over \$40,000.

In the colony of New South Wales the forest law dates from 1884, and makes provisions which are partially similar in character to those of the act just mentioned. In accordance with them an area of five and a-half million acres had been declared State forests and timber reserves in 1887.

Victoria, the smallest of the Australian colonies, is perhaps the most interesting from the forester's point of view. From certain reports made to the Secretary of State for the colonies it appears that in the year 1875 Victoria was suffering from a condition of affairs strongly suggestive of our own at present. "The amount of timber is diminishing owing to clearings for settlement, ordinary home consumption and bush (i. e. forest fires). . . . As early as 1866 attention was called . . . to the wastefulness and improvidence of the prevailing system."

Only the prime parts of trees were utilized. Immense numbers of standing trees were killed, owing to the practice of stripping from them large sheets of bark to cover, perhaps, a mere temporary hut. The committee called attention to the growing scarcity of timber for props for mining purposes and the necessity of measures to secure a permanent supply.

"In 1876 an act was passed, called the State Forest Act, which provided, first, for the appointment of local forest boards, which were to have the care of reserves and other Crown lands; secondly, for the appointment of foresters by local forest boards; and thirdly, for the promulgation by the Governor in Council of regulations prescribing the duties of these boards. In 1884 this act was superseded by a new one, which deals with the formation of State forests and timber reserves and their management, and with the management and disposal of timber and other forest produce not included in the State forests and timber reserves.

"The forests generally are worked under the license system, regulated by rules made under the act. There are licenses for felling, splitting, clearing undergrowth, the erection of saw-mills, grazing, the removal of bark, etc."

Unfortunately, this law, which has much to recommend it, has not resulted as well as was hoped, and the reasons for its failure have been defined as follows:

"The immediate causes of this failure are the bad license system, the ill-arranged classification of State forests, timber reserves and Crown lands, the absence of professional foresters to direct operations, and the neglect to reserve the best natural forests."

Dr. Schlich has formulated the requirements of the situation, as follows: First, the engagement of a thoroughly competent forest expert to be the head of the Victorian Forest Department; secondly, the selection, demarcation and legal formation of a sufficient area of reserved State forest, suitably distributed over the country, systematically managed, and efficiently protected; thirdly, the protection and disposal of forest

produce on Crown lands not included in the reserved State forests.

INDIA.

Perhaps the closest analogy to our own conditions in the magnitude of the area to be treated, the difficulties presented by the character of the country and the prevalence of fire, and the nature of the opposition which it encountered, is to be found in the forest administration of India, and that in spite of the tropical climate with which it has to deal. The history of the movement is comparatively fresh, and the fact that many problems remain as yet unsolved will scarcely detract from the interest and sympathy with which we may be led to regard it.

Systematic forest management was begun in India about thirty-five years ago, under difficulties not unlike those which confront us now. An insufficient or a wrong conception of the interests involved, the personal bias of lumbermen, the alternating support and opposition of the men in power, were the chief obstacles with which it had to contend; and against them were pitted the splendid perseverance and magnificent administrative powers of one man. The victory was brilliant, conclusive and lasting, and India has to thank Sir Dietrich Brandis for benefits whose value will go on increasing from age to age.

It is extremely interesting, in view of the beginning of State forest management, which must eventually and ought at once be made in the United States, to note that its success in India, in its early stages, was very largely due to the fact that it furnished a net revenue from the very start.

It is also instructive to recall that a large share of the prosperity of Rangoon, whose merchants protested in 1856 that to restrict the teak lumbering was to destroy the growth of their city, is due to-day to the steady business in this very timber which a conservative forest policy has secured.

"History has proved," says Dr. Schlich,¹ "that the preservation of an appropriate percentage of the area as forests cannot be left to private enterprise in India, so that forest conservancy in that country has for some time past been regarded as a duty of the State.

"Of the total area of government forests, which may perhaps amount to some 70,000,000 of acres, 55,000,000 have been brought under the control of the Forest Department. Of this area 33,000,000 are so-called reserved State forests, that is to say, areas which, under the existing forest law, have been set aside as permanent forest estates, while the remaining 23,000,000 are either protected or so-called unclassified State forests. These areas together comprise about 11 per cent. of the total area of the provinces in which they are situated. Rather more than half the area, or about 6 per cent., are strictly preserved and systematically managed forests."

The formation of these reserved State forests was the first step in systematic forest management, and it was carried out along lines which are typical. The forest areas were first selected, following standards which cannot be enumerated here, then surveyed and demarcated on the ground, and finally established as reserved State forests by an act which provided, first, for the presentation within a certain time of all claims against the State forests as demarcated; secondly, for their hearing and definite settlement; thirdly, that no prescriptive rights could accrue in reserved State forests after their declaration as such under the act; and fourthly, for the special treatment of forest offences.

These forests have been gradually brought under simple but systematic methods of management, which

¹ *Manual of Forestry*, Vol. 1, London, 1889.

aim at effective protection, an efficient system of regeneration, and cheap transportation, the whole under well-considered and methodical working plans.

The forest staff charged with carrying these plans into effect draws its controlling officers from England.

Until quite recently it had been the custom to send the young men selected for the Indian forest service to be educated on the continent of Europe, at first in France and Germany, but more lately altogether at the French school in Nancy. The arrangement was not satisfactory, however, and in 1885 the school at Cooper's Hill, near Windsor, was established as part of the Royal Indian Engineering College. It is an institution whose excellence is directly due to the admirable management of Dr. Schlich, formerly Inspector-General of Forests in India, and now its principal professor of forestry. The course, which in its general features resembles that of other forest schools of similar excellence, has recently been enlarged to cover three years, and includes as its final work an excursion of three months in the forests of the continent of Europe under the guidance of Sir Dietrich Brandis. The writer was fortunate enough to accompany the English students during the last one of these excursions, and can testify to its admirable educational value.

For the executive and protective work it is necessary to employ natives, since they alone are equal to the physical labor in so warm a climate. Their technical education is provided for by the Indian forest school, at Dehra Dun, in connection with which is the Dehra Dun State forest. Quite recently its first working plan has been completed for this forest, and while the management of no one forest can be taken

as a type of Indian forestry, it may not be without interest to sketch briefly its chief points. Each of the six ranges which the forest contains is divided into twenty compartments, or, in the Indian terminology, coupes, among which the fellings follow a regular sequence, so that each coupe is cut over once in twenty years. The period of work in each coupe really embraces three years, so that different stages of the operations are going on in three of them at the same time. During the first year the tropical creepers which interfere with the lumbering are cut through, and the trees which are to be taken out are selected, marked with the government hammer and girdled. The trees selected are sal (*shorea robusta*) which are unsound, or which would not improve during the next twenty years, trees of inferior species which will still furnish timber, and trees of other inferior kinds which are injuring by their shade the young sal seedlings. The timber trees which have been marked are sold by auction to a contractor, the unit of sale being the square mile, and are removed during the second year. In the third year the less valuable and the injured trees are cut out, hauled to the roads and sold as firewood. This method of lumbering has rightly been called "improvement felling," since their object is to raise the general condition of the forest rather than to draw from it a large annual revenue at present. For minor forest produce a system of sale by tickets is in force, it is said, with admirable result.

The difficulty of coping with forest fires in India would be notably greater than in the United States were it not for the greater density of the Indian population. The method consists in cutting fire paths

through the forest of a width varying up to four hundred feet, removing all combustible matter from them, except the larger trees, and patrolling them through the medium of a regular fire organization. All holders of prescriptive rights are bound to assist in the event of fire. At Dehra Dun, for instance, a force of five hundred men is available, and a fire is never allowed to burn for more than a couple of days. Smoking in the forest is strictly forbidden, and the building of fires by camping parties and others is very severely regulated.

The results of this thorough and far-sighted forest policy are conspicuous not only in the great fact that the forests yield, and will permanently yield, the supply of timber and forest produce which the population requires, but also in the beginning which has been made toward regulating the water supply in the mountains, and in the increasing capital value and annual net revenue of the State forests.

"So far," says Dr. Schlich,¹ "the government has good reason to be satisfied with the financial results of its forest administration. The net revenue, after meeting all expenses of the department, has been as follows since 1864, the year in which the department was first established as a general State department:

1864 to 1867.	Average annual net revenue....	£106,615
1867 to 1872.	" " " 133,929
1872 to 1877.	" " " 212,919
1877 to 1882.	" " " 243,792
1882 to 1887.	" " " 384,752

"There is little doubt, if any, that 25 years hence the net surplus will be four times the present amount if the government of India perseveres in its forest policy as developed in the past. Indeed it would not be going too far to say that the increasing forest revenue bids fair to become a substantial off-set against the expected loss of the opium revenue."

¹ Loc. cit.

There are two other facts resulting from the foreign policy of India which are of special significance to us as citizens of a country where any interference by the government with private rights would be so vigorously resented, and where private enterprise must consequently play so conspicuous a part. First, a body of efficient and experienced officers of all grades has gradually been formed in the State forests whose services are available for the management of private forests, and of communal forests when the time shall come to form them. Secondly, the example set by the well managed State forests and the steadily increasing revenue which they yield, has induced native and other forest proprietors to imitate the State.

The trained foresters, without whom so laudable a purpose must fail, are at hand, and the whole situation argues most favorably for the future prosperity of the country.

SOUTH AFRICA.

The organization of the Forest Service at the Cape of Good Hope is of comparatively recent date. It consists of one superintendent, three conservators, four assistant conservators, and the necessary staff of forest guards. Practically nothing had been done in the eastern half of the colony when Mr. Hutchins, the present conservator in charge of the Eastern conservancy, was called from India to the Cape. The method which he followed and its results are of interest both from the principles which they embody and from the success of his wise and energetic effort for the protection of the forest in the face of

popular and legislative neglect. The system of indiscriminate depredation which is so familiar to us in the United States was in full vogue when he arrived. His first work was to survey the boundary lines of the forest. He then succeeded in getting a bill through the Colonial Parliament, claims against the government forest area as he had surveyed it were heard and decided, and the lines of the State reserve were definitely fixed. He was now ready to regulate the management, which was accomplished on the following basis: The whole area, 150 square miles, was divided into a number of units called series (from a French forest term), and each series was again cut up into forty coupes, in one of which the cutting is localized each year. The system may be called, from a partial translation of its French name, "localized selection." It is a modification of what Dr. Schlich has called "the shelter-wood selection system." The beat of a guard is coextensive with a series, and within this area the felling passes over the same ground once in forty years. The faults of the present selection system are that the per cent. of the valuable timber trees is rapidly diminishing in a country where fire-wood is not saleable, and that it exposes the forest unduly to the attacks of fire, its chief enemy there as here. For these reasons the present treatment is to be gradually converted into regular high forest.

The volume and character of the trees marked to fall in each year are entered in a book, and from it the purchases are made. The buyer presents his felling license to the guard of the coupe in question, and cuts and removes the timber himself.

Excellent results are said to have followed a system of temporary permits to "forest cultivators," who are allowed to take up a certain area of land at the edge of the forest for agricultural purposes. In return, they are responsible for the police of the forest in their vicinity, and any unreported depredations mean to them the loss of their permit. Very often their contract demands the planting of a certain area with oak in lieu of a cash payment of rent.

The English oak and American cottonwood and the *Eucalyptus globulus* are extensively planted throughout the Cape and South Africa generally.

OTHER COUNTRIES.

It has been impossible more than to glance at the chief points of forest policy, in a few of the many lands which teem with interest in this respect. I would gladly have called attention to Austria, where an excellent forest service upholds the general principles which we have seen exemplified elsewhere, and to Italy, where the sale of government forests, forced on the State by the pressure of financial necessity, is beginning to bear evil fruit. A circle of lands around the Mediterranean might have been cited to instance the calamitous results of deforestation, and from some of them still further proof might have been adduced to show at what a cost such errors must be repaired. But the countries which have distanced us on the road toward a rational forest policy might better have claimed our attention.

Without passing out of the limits of Europe, it would have been worth while to glance at Sweden, whose government has recognized its obligations as

a forest proprietor, and to Russia, which has recently turned its attention to forest matters, and has passed a law (in 1888), of which the following are the more notable features: Clearing is forbidden in protection forests, and is only permitted in others when its effects "will not be to disturb the suitable relations which should exist between forest and agricultural lands." In standing timber all working which tends "to exhaust the standing crop, prevent the natural regeneration of the forest, and change the areas cut over into wastes" are forbidden. The government prepares working plans of protection forests without cost to their owners, and together with areas which have been replanted, these forests are free from taxes. Finally, private owners are forced to replant areas cut over which are without natural regrowth, and on their failure to do so, the work is carried out by the government foresters at their expense. All this in a country which has still 36 per cent. of wood land left.

Nor is it European nations and white colonists alone who have shown a far more intelligent comprehension of the significance of the forest than the United States. Japan has done so most conspicuously. To quote from Heinrich Semler:

"Japan,¹ whose total area includes in round numbers 94,900,000 acres, possesses forests of 28,700,000 acres in extent. This people furnishes a shining example in the matter of forestry. Even the old feudal lords were penetrated with the value of the wood lands, as they showed by the enactment of vigorous protective laws. When in the recent civil war the government of the Mikado destroyed the feudal system, it declared the forests, as far as they had belonged to the feudal lords, to be the property of the State, and promulgated a forest law which was valid for the whole kingdom. Accordingly the forests of Japan are about equally divided between

¹Semler, *Tropische und Nordamerikanische Waldwirtschaft und Holzkunde*. Berlin, 1888.

the State and private owners. The former manages its wood lands through a forest service with headquarters at Tokio, where is also the forest school. Founded within the last ten years, the school has an average attendance of about 150, and has quite recently been under the charge of Dr. Mayr, whose work on *The Forests of North America* has made his name familiar to the advocates of forestry in the United States. Only a part of the pupils expect to enter the government service.

"The forest service does not rest satisfied with the present proportion of wood land, but busies itself actively with planting, in connection with which the introduction of foreign species has been attempted.

"There is a notable export of wood from Japan to China, and, on the other hand, an import from North America to Japan; which last, however, the Japanese soon expect to be able to do without."

Dr. Schlich's statement of the destructive tendencies of private forest ownership in India might with equal truth have been made as a general proposition. It is the salient fact which the history of the forests of the earth seems to teach; but nowhere have the proofs of its truth taken such gigantic proportions as in the United States to-day. We are surrounded by the calamitous results of the course that we are now pursuing. In fact, it seems as though there were almost no civilized or semi-civilized country in either hemisphere which cannot stand to us as an example or a warning. To this great truth they bear witness with united voice: The care of the forests is the duty of the nation.

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